Amendment to the Claims

This listing of claims will replace all prior versions and listings of claims in the above-referenced application.

1. (Currently amended) A device for forming an array of magnetic particles, the device comprising: a substrate comprising a plurality of magnetic regions having gaps between them, wherein the substrate comprises a surface, wherein the magnetic regions have a maximum length parallel to the surface of the substrate and a maximum width parallel to the surface of the substrate with the maximum length being greater than the maximum width, and wherein the magnetic regions produce a plurality of localized magnetic fields when magnetized, and wherein adjacent magnetic regions are so aligned with one another in the directions of their maximum length that the localized magnetic fields are sufficient to trap a magnetic particle between adjacent ~~the~~ magnetic regions with a trapping energy at least three times greater than the thermal energy of the particle at room temperature and the gaps are available for fluid flow among them and for occupancy by magnetic particles prior to introduction of magnetic particles to the device so that forces generated by the localized magnetic fields between adjacent regions can trap magnetic particles in the gaps between them.

2. (Original) The device of claim 1, wherein the localized magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least an order of magnitude greater than the thermal energy of the particle at room temperature.

3. (Currently amended) A device for forming an array of magnetic particles, the device comprising: a substrate comprising a plurality of magnetic regions having gaps between them, wherein the substrate comprises a surface, and wherein the magnetic regions produce a plurality of localized magnetic fields when magnetized, wherein the magnetic regions have a maximum length parallel to the surface of the substrate and a maximum width parallel to the surface of the substrate, and wherein a plurality of regions are spaced apart along the dimension of the maximum length and a plurality of regions are spaced apart along the dimension of the maximum width, so that the distance separating adjacent regions in the dimension of the maximum length is less than the distance separating adjacent regions in the dimension of the maximum width, and, wherein the

localized magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least three times greater than the thermal energy of the particle at room temperature.

4. (Previously presented) The device of any of claims 1, 2, 3, or 5, wherein the thermal energy of the particle is approximately 0.025 eV.

5. (Currently amended) A device for forming an array of magnetic particles, the device having an upper surface and comprising: a substrate comprising a plurality of magnetic regions having gaps between them, wherein the magnetic regions have north and south poles that produce a plurality of localized magnetic fields when magnetized, wherein adjacent magnetic regions have ends with opposite magnetic polarities facing each other across a gap between them, wherein the magnetic regions are appropriately shaped and have an appropriate size so as to generate localized magnetic fields that exist substantially in a volume between adjacent north and south poles of adjacent magnetic regions above and parallel to the upper surface of the device and wherein the magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least three times greater than the thermal energy of the particle at room temperature and the gaps are available for fluid flow among them and for occupancy by magnetic particles prior to introduction of magnetic particles to the device so that forces generated by the localized magnetic fields between adjacent regions can trap magnetic particles in the gaps between them.

6. (Canceled)

7. (Currently amended) The device of any of claims 1, 2, 3, or [[to]] 5, wherein the magnetic regions project above the surface of the substrate.

8. (Original) The device of claim 7 wherein the magnetic regions have walls that are substantially perpendicular to the substrate.

9. (Original) The device of claim 7, wherein the magnetic regions comprise a layer of magnetic material and a layer of nonmagnetic material, wherein the layer of nonmagnetic material is located between the substrate and the layer of magnetic material.

10. (Original) The device of claim 1, wherein the magnetic material regions are arranged in a pattern of mutually perpendicular rows and columns.

11. (Original) The device of claim 1, wherein the magnetic regions are arranged in an array of subarrays configuration.

12. (Original) The device of claim 1, wherein the magnetic regions are substantially uniform in shape.

13. (Original) The device of claim 1, wherein the magnetic regions are substantially rectangular in shape.

14. (Canceled)

15. (Original) The device of claim 1, wherein the magnetic regions are substantially uniform in size.

16. (Original) The device of claim 1, wherein the number of magnetic regions is at least 1000 per centimeter squared.

17. (Original) The device of claim 1, wherein the number of magnetic regions is at least 10,000 per centimeter squared.

18. (Original) The device of claim 1, wherein the number of magnetic regions is at least 100,000 per centimeter squared.

19. (Original) The device of claim 1, wherein the number of magnetic regions is at least 250,000 per centimeter squared.

20. (Original) The device of claim 1, wherein the number of magnetic regions is at least 1,000,000

per centimeter squared.

21. (Currently amended) The device of claim 1, wherein adjacent magnetic regions are separated by a gap approximately equal in size to the size of a magnetic particle <u>having a largest dimension of less than approximately 200 μm</u>.

22. (Original) The device of claim 21, wherein the magnetic particle has a greatest dimension selected from the group consisting of: 30 nm, 100 nm, 300 nm, 500 nm, 1 μm, 3 μm, 5 μm, and 10 μm.

23. (Original) The device of claim 22 wherein the magnetic particle is substantially spherical, and the greatest dimension of the particle is the diameter of the particle.

24. (Original) The device of claim 1, wherein adjacent magnetic regions are separated by a gap having a greatest dimension approximately equal in size to the greatest dimension of a magnetic particle.

25. (Original) The device of claim 24, wherein the gap has a greatest dimension approximately equal in size to the greatest dimension of a magnetic particle having a greatest dimension selected from the group consisting of: 30 nm, 100 nm, 300 nm, 500 nm, 1 μm, 3 μm, 5 μm, and 10 μm.

26. (Original) The device of claim 25, wherein the magnetic particle is substantially spherical, and the greatest dimension of the particle is the diameter of the particle.

27. (Original) The device of claim 21, wherein the gap has a minimum length of approximately 1 micron.

28. (Original) The device of claim 21, wherein the gap has a minimum length of approximately 3 microns.

29. (Original) The device of claim 21, wherein the gap has a minimum length of approximately 5

microns.

30. (Original) The device of claim 1, wherein the magnetic regions comprise a magnetic material.

31. (Original) The device of claim 30, wherein the magnetic material is a ferromagnetic material.

32. (Original) The device of claim 1, wherein the substrate comprises a nonmagnetic material

33. (Original) The device of claim 1, wherein at least a portion of the device comprises a biocompatible material.

34. (Original) The device of claim 1, wherein at least the surface of the substrate and the magnetic regions comprises a biocompatible material.

35. (Original) The device of claim 32, wherein the magnetic regions are surrounded by nonmagnetic material.

36. (Original) The device of claim 32, wherein the substrate comprises silicon.

37. (Original) The device of claim 1, wherein the magnetic regions comprise cobalt.

38. (Original) The device of claim 1, wherein the magnetic regions are formed using photolithography.

39. (Original) The device of claim 1, wherein the magnetic particles are magnetic beads.

40. (Original) The device of claim 1, wherein the magnetic particles are paramagnetic particles.

41. (Original) The device of claim 1, wherein the magnetic particles are superparamagnetic particles.

42. (Previously presented) The device of claim 1, further comprising a flux circulator disposed around the magnetic regions.

43. (Previously presented) The device of claim 1, further comprising a plurality of photodetectors located in proximity to locations for trapping the magnetic particles so as to detect an optical signal from trapped particles.

44. (Currently amended) The device of claim 1, further comprising a microfluidic assembly, wherein the microfluidic assembly comprises channels positioned in communication with the magnetic regions so as to allow introduction of fluids to the magnetic regions via the channels so that the fluids contact the magnetic regions following introduction of the fluids via the channels.

45. (Original) The device of claim 1, further comprising a plurality of magnetic particles.

46. (Original) The device of claim 45, wherein the magnetic particles are substantially uniform in size and shape and are magnetic beads.

47. (Original) The device of claim 45, wherein the magnetic particles are substantially uniform in size and shape and are paramagnetic beads.

48. (Original) The device of claim 45, wherein the magnetic particles are substantially uniform in size and shape and are superparamagnetic beads.

49. (Original) The device of claim 45, wherein the magnetic particles are trapped by the localized magnetic fields.

50. (Original) The device of claim 45, wherein each of a plurality of the magnetic particles comprises a detectable moiety.

51. (Original) The device of claim 50, wherein the detectable moiety comprises a fluorescent or luminescent molecule.

52. (Original) The device of claim 50, wherein the detectable moiety comprises a nucleic acid.

53. (Original) The device of claim 52, wherein the nucleic acid comprises a hybridization tag.

54. (Original) The device of claim 45, wherein each of a plurality of the magnetic particles has a probe attached thereto.

55. (Original) The device of claim 54, wherein the probe comprises a binding ligand.

56. (Original) The device of claim 54, wherein the probe comprises a nucleic acid molecule.

57. (Original) The device of claim 54, wherein the probe comprises a protein.

58. (Original) The device of claim 1, further comprising a magnet for magnetizing and demagnetizing the magnetic regions.

59. (Currently amended) A device for forming an array of magnetic particles, the device comprising:

a substrate comprising a plurality of magnetic regions, wherein the substrate comprises a surface, and wherein the localized magnetic regions produce a plurality of localized magnetic fields concentrated in gaps between the regions, and wherein the magnetic regions project above the surface of the substrate and have a maximum length parallel to the surface of the substrate and a maximum width parallel to the surface of the substrate, with the maximum length being greater than the maximum width, wherein a plurality of regions are spaced apart along the dimension of the maximum length and a plurality of regions are spaced apart along the dimension of the maximum width, and wherein the distance separating adjacent regions in the dimension of the length is less than the distance separating adjacent regions in the dimension of the width.

60. (Original) The device of claim 59, further comprising a plurality of magnetic particles.

61. (Original) The device of claim 59, wherein the magnetic regions are substantially uniform in size and shape.

62. (Original) The device of claim 59, wherein the magnetic regions are arranged in a pattern of mutually perpendicular rows and columns.

63. (Previously presented) The device of claim 59, comprising:

a nonmagnetic substrate; and

a plurality of magnetic regions located on the substrate, wherein a localized magnetic field exists between adjacent magnetic material regions when magnetized.

64. (Original) The device of claim 63, further comprising a plurality of magnetic particles.

65. (Original) The device of claim 63, wherein the magnetic regions are substantially uniform in size and shape.

66. (Original) The device of claim 63, wherein the magnetic regions are arranged in a pattern of mutually perpendicular rows and columns.

67. (Original) The device of claim 63, wherein the magnetic regions project above the surface of the substrate.

68 – 112 (Canceled).

113. (Previously presented) The device of claim 1, 3, or 59, wherein the magnetic regions have a maximum length that is between 3 and 5 times as great as the maximum width or between 5 and 10 times as great as the maximum width.

114. (Previously presented) The device of claim 1, 3, or 59, wherein adjacent magnetic regions are separated by a gap of between 1 and 5 microns or between 5 and 15 microns.

115. (Previously presented) The device of claim 1, 3, or 59, wherein the magnetic regions are not rectangular.

116. (Currently amended) A device for forming an array of magnetic particles, the device comprising: a substrate comprising a plurality of magnetic regions, wherein the substrate comprises a surface and the magnetic regions have a maximum length parallel to the surface of the substrate and a maximum width parallel to the surface of the substrate, with the maximum length being greater than the maximum width, and wherein the magnetic regions produce a plurality of localized magnetic fields when magnetized, and wherein the magnetic regions are not rectangular.

117. (Previously presented) The device of claim 116, wherein the localized magnetic fields the localized magnetic fields are sufficient to trap a magnetic particle between the magnetic regions with a trapping energy at least three times greater than the thermal energy of the particle at room temperature.

118. (Previously presented) The device of claim 116, wherein the magnetic regions project above the surface of the substrate.

119. (Previously presented) The device of claim 1, wherein the size, shape, and spacing of the regions are selected to increase the likelihood of trapping only a single magnetic particle within the gaps.

120. (Previously presented) The device of claim 1, wherein the distance between the ends of adjacent magnetic regions in the dimension of the maximum length is 200 microns or less.

121. (Currently amended) A device for forming an array of magnetic particles, the device comprising:

a substrate comprising a plurality of magnetic regions, wherein the substrate comprises a surface, and wherein the localized magnetic regions produce a plurality of localized magnetic fields concentrated in gaps between the regions, and wherein the magnetic regions project above

the surface of the substrate and have a maximum length and a maximum width, with the maximum length being greater than the maximum width by a factor of at least 5.

122. (Currently amended) A device for forming an array of magnetic particles, the device comprising: a substrate comprising a plurality of magnetic regions, wherein the substrate comprises a surface, and wherein the magnetic regions produce a plurality of localized magnetic fields when magnetized, and wherein the localized magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least five times greater than the thermal energy of the particle at room temperature, wherein the magnetic regions comprise cobalt and project above the surface of the substrate.

123. (Previously presented) A device for forming an array of magnetic particles, the device comprising: a substrate comprising a plurality of magnetic regions, wherein the magnetic regions produce a plurality of localized magnetic fields when magnetized, and wherein the localized magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least five times greater than the thermal energy of the particle at room temperature, further comprising a plurality of photodetectors located in proximity to locations for trapping the magnetic particles so as to detect an optical signal from trapped particles.

124. (Currently amended) A device for forming an array of magnetic particles, the device comprising: a substrate comprising a plurality of magnetic regions, wherein the magnetic regions produce a plurality of localized magnetic fields when magnetized, and wherein the localized magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least five times greater than the thermal energy of the particle at room temperature, further comprising a microfluidic assembly, wherein the microfluidic assembly comprises channels positioned in communication with the magnetic regions so as to allow introduction of fluids to the magnetic regions via the channels so that the fluids contact the magnetic regions following introduction of the fluids via the channels.

125. (New) A device for forming an array of magnetic particles, the device comprising:

a substrate comprising a plurality of magnetic regions, wherein the substrate comprises a surface, and wherein the localized magnetic regions produce a plurality of localized magnetic fields concentrated in gaps between the regions, and wherein the magnetic regions project above the surface of the substrate and have a maximum length parallel to the surface and a maximum width parallel to the surface, wherein the maximum length is between 3 and 5 times as great as the maximum width or between 5 and 10 times as great as the maximum width.